

**Tribhuvan University**  
**Institute of Science and Technology**

**Bachelor of Science in Computer Science and Information Technology**

**Level: Second Semester**

**Course Title: Microprocessor**

**Course no.: CSC 153**

**Full Marks: 60+20+20**

**Credit hours: 3**

**Pass Marks: 24+8+8**

**Nature of Course:** Theory (3 hrs.) + Lab (3 hrs.)

**Course Synopsis:** This course contains of fundamental concepts of computer organization, basic I/O interfaces and interrupt operations.

**Goal:** The course objective is to introduce the operation, programming and application of microprocessor.

**Unit 1: Introduction (3 hrs)**

- Definition of microprocessor and its application
- Evolution of microprocessor
- Von Neumann architecture
- Basic organization of microprocessor
  - Microprocessor: Arithmetic and Logic unit (ALU), Control unit (CU), Registers
  - Memory
  - Input / Output
  - System bus: Data, Address and Control bus

**Unit 2: Basic Computer Architecture (10 hrs)**

- SAP-1 architecture: Block diagram, and function of each block 2 hrs
  - 8-bit “w” bus
  - 4-bit program counter
  - 4-bit memory address register (MAR)
  - 16x8 bit memory
  - 8-bit instruction register (IR)
  - 8-bit accumulator
  - 8-bit B register
  - 8-bit adder-subtractor
  - 8-bit output register
- SAP-1 instructions 1 hrs
  - LDA, ADD, SUB, OUT, HLT
- Fetch and execution cycle of SAP-1 instructions 2 hrs
  - Fetch cycle: Address state, Increment state, Memory state
  - Execution cycle of LDA, ADD instructions

- Microprogram 1 hrs
  - Microinstructions of SAP-1 instructions
- SAP-2 architecture: Block diagram and functions of each block 2 hrs
- Architectural differences with SAP-1 0.5 hrs
  - Bidirectional registers
  - Flags
- Instruction sets 1.5 hrs

### **Unit 3: Instruction Cycle (3 hrs)**

- Instruction cycle, machine cycle and T-states 1 hrs
  - Machine cycle of 8085 microprocessor: op-code fetch, memory read, memory write, I/O read, I/O write, interrupt
- Fetch and execute operation, timing diagram 1.5 hrs
  - Timing diagram of MOV, MVI, IN, OUT, LDA, STA
- Fetch and execution overlap 0.5 hrs

### **Unit 4: Intel 8085/8086/8088 (8 hrs)**

- Intel 8085 microprocessor 4.5 hrs
  - Functional block diagram
  - Pin configuration
  - Description of each block: Registers, Flag, Data and address bus, Timing and control unit, Interrupts
  - Instructions: op-code and operands
  - Addressing modes
  - Instructions and data flow
- Intel 8086/8088 microprocessor 3.5 hrs
  - Functional block diagram of 8086 microprocessor and description of each block, Registers, Flags, Address and Data bus
  - Introduction to 8088 microprocessor and its block diagram
  - Comparison with 8085 microprocessor
  - Assembly instructions, mnemonic and operands
  - Addressing modes

### **Unit 5: Assembly Language Programming (9 hrs)**

- Programming with Intel 8085 microprocessor 4.5 hrs
  - Instruction format
  - Instruction types: Data transfer, Arithmetic, Logic, Branching, Miscellaneous
  - Simple sequence programs, Branching, Looping
- Programming with Intel 8086 microprocessor 4.5 hrs
  - Assembly instruction format

- Mnemonics and Operands
- Macro assembler
- Assembling and linking
- Assembler directives, comments
- Instruction sets
  - Data transfer:- MOV, IN, OUT, LEA
  - Arithmetic and logic:- ADD, SUB, INC, DEC, MUL, DIV, AND, OR, XOR, NOT, CMP, DAA, AAA, ROR, RCR, ROL, RCL, SHL, SHR
  - Branching:- JMP, CALL, RET, LOOP
  - Stack:- PUSH, POP
- INT 21h functions
  - 01H, 02H, 09H, 0AH, 4CH
- INT 10h functions
  - 00H, 01H, 02H, 06H, 07H, 08H, 09H, 0AH
- Simple sequence programs, Branching, Looping
- Debugging

#### **Unit 6: Basic I/O, Memory R/W and Interrupt Operations (6 hrs)**

- Memory read/write, input/output, read/write operation in 8085 microprocessor based system 1 hrs
- Direct memory access (DMA) 1.5 hrs
  - Introduction, advantage and application
  - DMA controller 8237 interfacing
- Interrupt 1.5 hrs
  - 8085 interrupt pins and interrupt priority
  - Maskable and non-maskable interrupts
  - Vector and polled
- 8259 operation 2 hrs
  - Block diagram and explanation
  - Priority modes and other features

#### **Unit 7: Input/output Interfaces (6 hrs)**

- Parallel communication – introduction and applications 0.5 hrs
- Serial communication 1.5 hrs
  - Introduction and applications
  - Introduction to Programmable Communication Interface 8251
  - Basic concept of synchronous and asynchronous modes
- Simple I/O, Strobe I/O, Single handshake I/O, double handshake I/O 0.5 hrs
- 8255A and its working 1.5 hrs
  - Block diagram
  - Modes of operation

- Control word
- RS-232 – Introduction, pin configuration (9 pin and 25 pin) and function of each pin,  
Interconnection between DTE-DTE and DTE-DCE 1 hrs
- Keyboard and di-play controller: Introduction to 8279 1 hrs

#### References:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming, and Applications with 8085,  
Prentice Hall  
(For unit 1, 3, 4, 5, 6 and 7)
2. A.P. Malvino and J.A. Brown, Digital Computer Electronics, Tata McGraw Hill  
(For unit 2)
3. D.V. Hali, Microprocessors and Interfacing – Programming and Hardware, McGraw Hill  
(For unit 4, 5, 6 and 7)
4. Peter Abel, IBM PC Assembly Language Programming, McGraw Hill  
(For unit 4 and 5)